Chasing the Chatbots: Directions for Interaction and Design Research

Conference or Workshop Item

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Directions for Interaction and Design Research

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Abstract Big tech-players have been successful in pushing the chatbots forward. Investments in the technology are growing fast, as well as the number of users and applications available. Instead of driving investments towards a successful diffusion of the technology, user-centred studies are currently chasing the popularity of chatbots. A literature analysis evidences how recent this research topic is, and the predominance of technical challenges rather than understanding users' perceptions, expectations and contexts of use. Looking for answers to interaction and design questions raised in 2007, when the presence of clever computers in everyday life had been predicted for the year 2020, this paper presents a panorama of the recent literature, revealing gaps and pointing directions for further user-centred research.

Keywords: Chatbots · Interaction Design · Conversational interfaces.

1 Introduction

More than 10 years ago, in 2007, Human-Computer Interaction (HCI) researchers and practitioners discussed how technology would shape society and how the HCI community should be prepared for that. In the seminal report *Being Human: Human-computer Interaction in the Year 2020* [4], the authors predicted, among other things, a growing presence of *"increasingly clever computers"*, and a more socially-connected world.

Indeed, social and the so-called smart technologies are becoming an important part of daily life activities in general. Also, better connectivity and recent advances in Machine Learning and Natural Language Processing (NLP) are some of the factors favouring the development and dissemination of the clever computers. Additional to that, a number of "user-friendly" toolkits for the design of conversational interfaces (i.e. DialogFlow, Wit.ai, etc.) are recently supporting the dissemination of chatbots as a user interface for services in general [25].

Not only the well-known voice-based services like Amazon Alexa, Siri and Google Home are becoming popular in the domestic environment, but the mainly

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textual chatbot based on the Facebook Messenger platform has also been extensively explored commercially. According to [8], Facebook Messenger, Skype, Slack, etc. together are already hosting more than a million chatbots. Facebook Messenger alone hosts more than 300,000 of them [10]. These numbers are expected to increase in a short time. One indication comes from a recent report on emerging technologies and marketing by Oracle [17]. They found that 80% of consumer brands will be using chatbots for customer interactions by 2020. To date, 36% of the brands have already implemented one. In this context, the chatbots are mostly utility-driven, designed to provide specific and limited services to the user like the pioneer bot to assist with booking flights[1], for choosing a wine[2], or providing e-gov support[3].

Back in 2007, the authors of [4] precisely predicted computers to become more and more present in our lives, more independent and the interaction more like a human-human conversation rather than instruction-based. In that context where we would be living with *"increasingly clever computers"*, these authors raised 3 questions related to interaction and design [4](pg 40):

1. *What will be an appropriate style of interaction with clever computers?*
2. *What kinds of tasks will be appropriate for computers and when should humans be in charge?*
3. *How can clever computers be designed to be trustworthy, reliable and acting in the interests of their owners?*

We dig into these three questions to analyse the literature on chatbots design and evaluation, evidencing that they are still open issues now, 10 years later, despite the extensive commercial adoption already in place.

As stated in [2], we have recently faced a substantial technology push in chatbot development. But a potential enthusiasm of the users can be led to frustration or disappointment - and rejection - if the technology does not meet the users' expectation, as some reports of failure have recently shown [19,2,9].

Aspiring to a long-life to chatbots, in this paper, we provide an overview of user-centred research discussing pieces of evidences collected in the field [19], as well as some findings and gaps from the literature. We aim at pointing to directions for further research that intend to achieve impact by exploring the potential of chatbots in engaging with the users.

The paper is organised as follows: in Section 2, we present a brief analysis of the computing literature looking at how user studies have grown along the years, evidencing how recent is this endeavour. In Section 3 we summarise a user study in a humanitarian scenario. In Section 4 we analyse the interaction and design research questions. Finally, in Section 5 we discuss the findings pointing to research directions. Section 6 concludes the paper.

[1] KLM Blue Bot: https://bb.klm.com/
[2] Lidl Winebot: http://www.facebook.com/lidluk/
[3] Emma, Virtual Assistant of the US Citizenship and Immigration Service: https://www.uscis.gov/emma

2 Chatbots Literature Overview

To build a perspective on how the Human-Computer Interaction research domain have coped with this "chatbot wave", we have analysed the ACM Guide to Computing Literature digital library, which contains 2,795,980 records to date on *"all publishers in computing"*[4]. This search includes publications on the topic of 'chatbots' and 'conversational interfaces'. Any publication including at least one of these terms in the title, authors' keywords or abstract has been considered. A total of 330 publications were found between the years of 1975 and 2018.

By filtering the results looking for publications addressing any of these terms (or similar to) 'user(s) study', 'design', 'user evaluation', 'guidelines' in the abstract, a total of 131 entries have been identified and verified. As the chart in Figure 1 illustrates, research on conversational interfaces is not a recent endeavour, actually, they have been present along most of the computing history, but the peak of interest in the last few years reflect the recent commercial boost. Following that, 46% of the user studies identified in this analysis are concentrated in the years of 2017 and 2018.

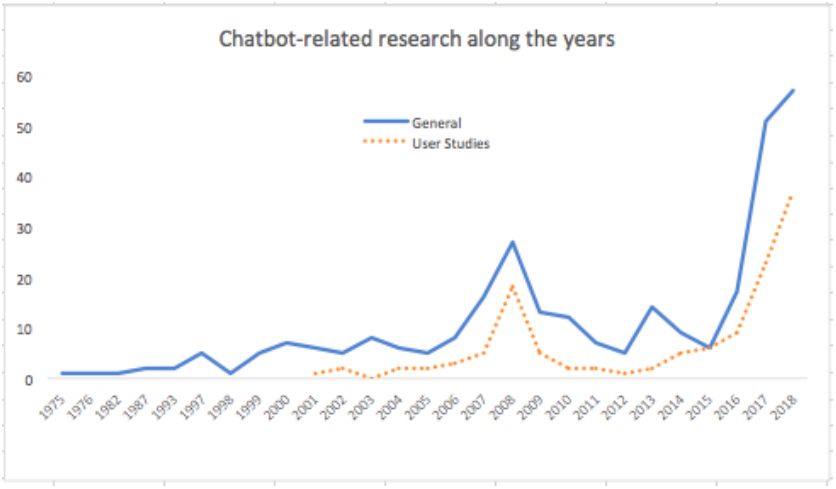

Figure 1. Number of general publications on chatbots or conversational interfaces on ACM along the years and publications addressing user-related studies

As an indication of the research focus in the Computer Science and HCI literature, the word-cloud in Figure 2 illustrates the 20 most frequent keywords used by the authors of the 131 papers addressing users' studies in some way. The words 'chatbot(s)', 'conversational interface(s)', 'conversational agent(s)' have been excluded to make the other complementary terms more evident.

[4] as informed by ACM at https://dl.acm.org/advsearch.cfm

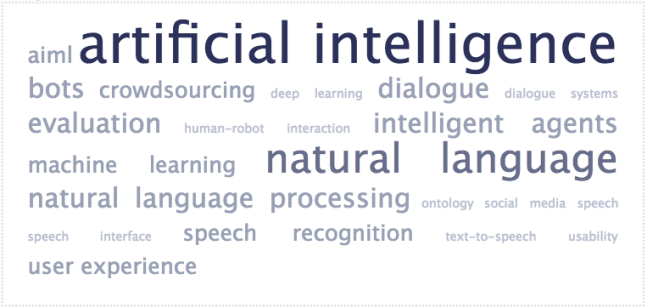

Figure 2. Most common authors' keywords used in the papers addressing user studies

The fact that the authors' keywords not always properly represent the focus of the paper is acknowledged and can be considered a limitation of this analysis. But as a "thermometer" of the research domain, the word-cloud evidences the predominance of studies addressing aspects of Artificial Intelligence and Natural Language Processing when compared to more HCI-related topics like 'user experience' or 'usability'. Other terms suggesting more specific studies on users' perception, impact, adoption, etc., were not revealed.

This result suggests that technical challenges referring to advances in AI and NLP have been a research priority, and the efforts are not balanced when it refers to understanding the real impact of the technology to the users and to society. As already stressed by [6] and [31], although the engagement potentials of the chatbots have already been explored, how to design them to promote impact and a consequent "social good" is an emerging topic that deserves attention [7].

In line with that, in the next section, a field study that applied a Facebook chatbot in a humanitarian scenario is briefly summarised, illustrating why studies of this nature are essential for the success of the technology.

3 A Case Study Involving First-time Users

As fully reported and analysed in [19], the authors of this paper piloted a study in the humanitarian context in Kenya. A Facebook Messenger chatbot was promoted for citizens to access Uchaguzi[5], a socio-technical initiative based on a crowdsourced platform to ensure peace and transparency during the presidential elections, which happened in October 2017.

The platform is based on Ushahidi[6], which collects and maps geo-tagged and validated reports from citizens that experienced any incident violating human rights or corruption. The reports can be generated directly on the platform website, via SMS, Twitter, phone, and in the context of this study, via the chatbot available on Uchaguzi's Facebook page.

[5] https://uchaguzi.or.ke/
[6] www.ushahidi.com

Advertised on Facebook, the chatbot attracted more than 3,000 visits. Despite of that, only 55 reports to the platform were completed via the chatbot. In around 50% of the visits, users just browsed and left the application. Reports were actually created in 38% of the visits (1,152), but the users either abandoned or got lost while interacting with the chatbot, and did not complete the interaction. The contents of these incomplete reports were manually extracted by technical volunteers that actually added 900 of them to the platform.

The interaction design and logged data were subsequently inspected by a specialist [19] and some design issues were identified. Nevertheless, the main barrier faced by the users that actually intended to create a report was the mismatch between the design and their expectation. Following Facebook best practices, the design mixed conversations and Graphical User Interface (GUI) elements [5]. The far majority of users, though, ignored (or did not make sense) of the GUI, which supposed to facilitate the interaction, and have tried (and failed) to engage in a pure conversation. A fully conversational interaction would not be the best solution while conversations are expected to breakdown due to technological limitations [5], therefore frustrating and disappointing inexperienced users.

The findings reported in [9] are in line with that. Also investigating the impact of Facebook Messenger chatbots from first-time users' perspective, the study involved 16 participants and evaluated 8 popular chatbots. Participants revealed that their expectations were not met and reported to be either disappointed or frustrated with the restricted natural language capabilities and the limited set of features offered by the chatbots.

As pointed out by Følstad and Brandtzæg [6], chatbots hold great potential as an inclusive technology, opening doors of digital services to people still unfamiliar with them. In the study in Kenya [19], it opened the doors of a crowdsourced based platform to more than 1,500 people that tried to generate a report during the presidential elections. The impact, though, could be even bigger if more people could have made sense of the functioning of the chatbot, followed the navigation and fully engaged with the service. This could potentially be possible if the design had considered the first-time users need to understand the interaction style, eventually being more thoroughly guided throughout the service.

As [2] states, deploying a chatbot as a service interface is not only a matter of developing a new front-end, because users have new motivations and patterns of use in this case. Without understanding the people who use the chatbots, how do they use it, and their goals and expectations, it is hard to predict a sustainable adoption and impact of this technology.

4 Interaction and Design Questions

The empirical experience summarised above illustrates the need for further investigations on interaction and design towards fully exploring the potentials of chatbots for a positive social impact. Aiming at situating the state of the art in this domain, in this section, we look at publications addressing users' studies

(as described in Section 2) to find answers to the three interaction and design questions raised in 2007 [4].

4.1 Appropriate Interaction Style

1) What will be an appropriate style of interaction with clever computers?

The recent platforms for chatbots design are usually featured with powerful tools for creating conversational interfaces in the most popular languages, but they do not define the interaction style, which is a designer's choice [16]. As the examples below evidence, it does not exist only one interaction style that fits all chatbots and chatbots users.

In [20], the study focused on the interaction with a virtual home assistant in a domestic environment. The authors claim that in this scenario the interaction is not exactly 'conversational'. Instead of a dialogue, the interaction with the device tends to be an isolated action embedded in the householders' dynamic and conversations [20].

Considering also textual chatbots, [31] suggests taking the context into account when selecting the right interactive elements for mobile chatbots, such as displaying a menu of options or voice input to reduce errors, and typing when the task requires reflection or a confirmation.

Particularities of a specific group of users were evidenced in [19], situated in the humanitarian context, and [9], which analyses a variety of chatbots. In both cases, the authors shed lights on the specific needs and expectations of first-time users that may impact adoption and further appropriation of the technology.

As for any other interactive technology, in order to understand what is indeed the appropriate interaction style for a chatbot, it needs to be designed for (or with) groups of users, considering their specific needs and goals, and also be evaluated from the users' perspective. Different users' goals and platforms, such as Slack, Facebook Messenger, mobile conversational agents, or virtual home assistants, may lead to significant implications for the interaction style. Despite that, chatbots design usually follow a presumably one-size-fits-all approach, in which particular preferences, contexts, and needs are not considered [6].

As pointed out by [6], designing chatbots challenges some interaction and design foundations, since the traditional focus on graphical interfaces moves towards designing for services and a conversational flow, which is not fully predictable and very dependent on the input by the users.

For supporting designers/developers with possibilities, in [18], the authors propose a framework with six key dimensions along which chatbots may differ:

1. Type: performing informative, collaborative (with users) or automated tasks.
2. Direction: input only (monitoring conversations), output only (adding content to the conversation without considering the input), both.
3. Guidance: human-mediated or autonomous;
4. Predictability: deterministic or evolving (with learning components);
5. Interaction style: dull (using simple words and repetition), alternate vocabulary (adding alternative phrases to the dull), relationship builder (building

a rapport, more spontaneous/funny behaviour, requiring planning conversational flows), human-like (learn from the history of conversations thus offer more meaningful interactions);
6. Communication channel: text, voice, or both.

Although displaying a range of possibilities with variable technical complexity, for example excluding or including AI components, this is a generic framework with no intention to provide design guidelines.

Considering the diversity of possibilities and expectations from users, as [2] states, it is crucial to inform potential users about the chatbots capabilities, what they are able (and not able) to deliver.

Evaluating: Assessing the success or adequacy of a chatbot interaction style also challenges traditional concepts as usability, as the humanised relation between user and chatbots brings to light a number of subjective aspects, some of them hard to be formalised and measured.

Radziwill and Benton [21] and Zamora [31] are some of the authors that have investigated quality attributes expected for chatbots. Some human-like attributes considered in these studies together includes *knowledgeable, likeable, politeness, sensitive to social concerns, reliable, enjoyable, personable, smooth, seamless, personality traits*, among others. In addition, [11] explores aspects of *playfulness* and [30] is pursuing *empathy*, both considering also automated detection methods to evaluate the chatbot. Another study [29] from a machine learning perspective explored as chatbots characteristics *self-consciousness, humour, purity, IQ* and *EQ (intelligence and emotional quotient), memory, self-learning* and *charisma*. As mentioned in [19], the adequacy of these characteristics may vary from context to context and according to the group of users. In the humanitarian context, for example, while humour can be inappropriate, empathy may play a role in building up trust.

Some of the attributes above mentioned have already been investigated in the context of HCI or user experience, like pursuing and enjoyable interaction [14], for example. Even in those cases, specific investigation is required to deal with the particularities of conversational interfaces. The complexity of humanised attributes such as *sensitiveness to social concerns, personality traits*, etc., requires a multidisciplinary approach for detection and evaluation considering users' perception and consequent impact.

4.2 Appropriate Tasks

2) What kinds of tasks will be appropriate for computers and when should humans be in charge?

As the literature suggests, users' perception and expectations from chatbots may change dramatically from one platform to another, considering textual chatbots, virtual home assistants, Slack, etc. Studies addressing the real impact of chatbots for the users are still rare [12], and some authors actually question the reputation of chatbots with regard to their usefulness, arguing that their development is often pushed by marketing pressure, without taking into account users' real needs and motivations [6].

Looking more specifically at voice-based interfaces, both [20] and [12] highlight the need for more studies on social and interactive aspects of this technology in daily life. For [20], this literature gap is significant and little is known about the real impact of the technology and how interaction design should properly address it. The study reported in [31] had 54 participants in India and the United States using voice and text chatbot applications to report their perceptions on, among other things, what chatbots were good for. Beyond usual menial tasks, some people reported interest in chatbots for fulfilling emotional needs, such as someone to provide motivation or someone to listen without judging. Other participants found chatbots adequate for sensitive content that is too embarrassing to ask another human about. A preference for not engaging with potentially risky tasks, which could fail due to mishandling data, such as social media and finance-related data were also pointed out in this study. There is still a lack of trust in technology, as further discussed. Similarly, participants in [12] were reluctant to use conversational agents for complex or sensitive activities.

In another study [1], 146 chatbots users based in the US revealed that they are mainly looking for having some tasks related to assistance or information executed promptly and efficiently. Some users also reported entertainment, fun, or social and relational factors, such as reducing loneliness, as a motivation for using chatbots. In [13], though, the authors warn about potential risks of dealing with humans' emotions, such as leading to an excessive emotional attachment.

The experience in Kenya [19] suggested the potential of chatbots for crises situations where people with different levels of familiarity with technology could make use of a known user-interface to report issues. Otherwise, they would have to remember or install specific platforms for this end.

As discussed in [6], chatbots hold potential for positive social change, which can be related to well-being, welfare, supporting learning or connecting people. While the majority of applications are still dedicated to media access, marketing and customer service [6], applications like virtual therapists[7], virtual friend[8], or support to deal with distressful situations like harassment at workplace[9] are emerging. However, to consolidate the technology, systematic ways to measure the positive impact and drawbacks of these applications are necessary.

4.3 Towards Trustfulness

3) How can clever computers be designed to be trustworthy, reliable and acting in the interests of their owners?

The experience reported in [19] illustrates the contrast between the users' expectations to engage in a proper conversation with the pre-set-answers based design. Other reports in the literature also focus on the mismatch between the users' expectations and system operation and the consequent resistance in assigning complex tasks to the conversational agents [12,9,31].

[7] https://woebot.io
[8] https://replika.ai/
[9] https://talktospot.com/

Dealing with the immaturity of the technology in keeping a natural conversation is the current main obstacle to gain users' trust and confidence. Moore et al [16] have framed these design challenges of managing the dialogue and the conversational context as Conversational User Experience (UX).

Keeping the conversation flow: The openness of conversational interfaces and variations in the user input are the main challenges in chatbot design and evaluation [28]. In the current state of the technology, any chatbot design has to properly address conversations breakdowns [6]. Recognising that, as part of their design guidelines Facebook suggests that designers cannot expect perfection, because people behave in an unexpected way [5]. To properly perform their tasks, especially the AI-powered chatbots require substantial adaptation and maintenance [2]. For assisting the interaction design, in [26] the authors introduce a tool to support designers exploring and prioritising dialogue failure points with suggestions on how to fix them; and in [28], a qualitative method for inspecting the communicability of the chatbot is proposed.

Whether there is a boundary for that, a limit of tolerance from the users to deal with conversations breakdown is still an open question.

Keeping the context: The human capacity to infer things and deal with ambiguities in a conversation is not yet mastered by the 'clever computers'. Managing the conversation context is probably one of the most challenging aspects of designing a chatbot [25]. Participants of the study in [8] felt that, finding it difficult to use chatbots for complex tasks as they are constantly unsure about the chatbots contextual state. The mismatch between the chatbots context in the conversation and the users perception of the chatbots understanding leads to confusion and consequent dialogue breaks [8]. Reflecting this feeling, participants of [3] wished their virtual assistant could clarify unclear requests or context and better handle errors before giving a random or generic answer like 'I don't know how to help with that'. The authors in [8] suggested a graphical tool added to the chatbot interface displaying the conversational context and providing interactions with the context values. The recent publication on Conversational UX [15] provides a framework that includes an interaction model for keeping a conversation flow, conversational patterns, a method for navigating conversational interfaces, and performance metrics.

Beyond the quality and naturalness of a conversation flow, building trust may also refer to human characteristics of the interlocutor, including the chatbot attitude. As an example, being trustworthy has been a target for a fashion-related chatbot [27]. To achieve that, specific features and vocabulary that would also work better to gain someone's trust in a purely human context have been considered in the chatbot design.

As previously mentioned in the section 4.1, pursuing human characteristics has been considered a desirable aspect for a chatbot [31,21]. However, there is a lack of experiences in the literature regarding the users' perception of trust and how human elements may impact that in terms of engagement and motivation.

In [2], the authors refer to this dilemma mentioning Anna, a chatbot launched by a furniture retailer in 2006 that was considered unsuccessful for being too human, thus diverting the real purpose of the chatbot.

The discussion around trust can take a different level when shedding lights on ethical behaviours, such as bias. In [24], for instance, the authors investigate how to handle race-talks with a chatbot from a socio-technical perspective. AI-based applications require a wider and deeper discussion on ethical aspects, as initially addressed in [23].

5 Discussions and Research Directions

The literature review revealed several gaps in the user-centre research on how to properly design and evaluate chatbots considering a diversity of contexts, types of services and how to cope with the current limitations of technology without compromising trustworthy.

According to the Diffusion of Innovation model by [22], a technology in its infancy is usually in the hands of the innovators and early adopters, typically users with a higher tolerance for risk and complexity. However, the majority of people tend to have different expectations and thresholds when adopting it (or not). For this reason, we argue for the importance of boosting user-centred research towards filling these gaps.

By answering the interaction and design questions from [4], it was possible to build a panorama of the state of the art and find some directions for further research towards fully exploring the potential of chatbots, summarised as follows:

Interaction style should vary according to the platform, the chatbot capabilities, target audience, and context of use. Studies addressing how users are interacting with chatbots in specific platforms started to emerge mainly targeting the home assistants, but further research should consider also:

- Addressing other specific platforms (and users' motivations) like Facebook, Slack, Skype, etc.
- Experiences 'in the wild', in which variables like quality of connectivity, diversity of devices, multiple languages, etc., tend to emerge.
- Guidelines on defining the chatbots capabilities according to the context, such as when using or not AI, mixing graphical elements, etc.
- Pursuing systematic ways to design and evaluate human attributes, considering both the adequacy from the users' perspective and ethical boundaries.

Appropriate tasks for chatbots so far include improving productivity of menial and routine activities, and entertainment. There is a recognised potential for using chatbots for fulfilling emotional needs, addressing sensitive topics with privacy, and in humanitarian contexts.

- Further research is necessary for assessing the real value and impact of a diversity of applications to specific target audiences, especially those that touch emotional aspects of the users or aim to promote positive social changes.

Trustworthy is still an aspiration for most of the chatbots mainly due to the current limitations associated to conversational interfaces. Guidelines to keep an acceptable user experience in such scenario have just emerged, but additional research should include:

- Addressing limits of users' tolerance and impact of conversation breakdown on technology acceptance.
- Guidelines on how to communicate chatbots capabilities to (new) users.
- Systematic ways to assess trustworthy from the users' perspective.

6 Final Remarks

By analysing some computer science literature related to user studies on chatbot and conversational interfaces, this paper evidenced that despite the popularity of the technology in the market and the fast-growing number of users and applications, the users' perspective is a very recent subject of research. Yet, some reports of failure due to users' frustration or disappointment are emerging. The reasons are many, including not properly addressing limitations of the technology, excess of humanness, and also due to the mismatch between expectations and needs and the chatbot operation. We argue that the need for more user-centred research is significant and urgent in order to establish the technology within different contexts and for specific groups of user, therefore fully exploring the technology potential and ensuring its endurance.

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